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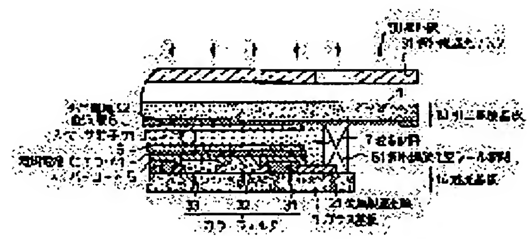
(54) MANUFACTURE OF LIQUID CRYSTAL PANEL

(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture the panel excellent in display quality and free from abnormal orientation by sufficiently setting UV curing resin adhering an extraction electrode substrate and a light shield substrate by the manufacturing method using liquid crystal dripping.

SOLUTION: After UV curing seal resin 81 is formed at the periphery of the display area of a glass substrate 1 which has an extraction electrode 42 formed of a metallic thin film or glass substrate 1 having a light shield film 21 at the periphery of the display area and a liquid crystal material 7 is dripped by a specific amount in the display area of one of the substrates, the two substrates are put one over the other and irradiated with ultraviolet rays from the glass substrate side having the metallic extraction electrode 42 or both the side of the two substrates to set the seal resin 81.



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CLAIMS

[Claim(s)]

[Claim 1] Ultraviolet curing mold seal resin is applied to the viewing-area periphery of either substrate of the glass substrate which has the drawer electrode formed with the metal thin film, and the glass substrate which has the light-shielding film formed in the viewing-area periphery with the metal thin film. Furthermore, the manufacture approach of the liquid crystal panel characterized by having the glass substrate lamination process which irradiates ultraviolet rays from the glass substrate side which has superposition and a metal drawer electrode for two substrates, and hardens seal resin after the liquid crystal ingredient of the specified quantity is dropped at the viewing area of one of substrates.

[Claim 2] The manufacture approach of the liquid crystal panel according to claim 1 characterized by for the width of face of the drawer electrode of a field which laps with ultraviolet curing mold seal resin being 40 micrometers or less, and being 2.5 or less times of distance with the drawer electrode which adjoins further.

[Claim 3] Ultraviolet curing mold seal resin is applied to the viewing-area periphery of either substrate of the glass substrate which has the drawer electrode formed with the metal thin film, and the glass substrate which has the light-shielding film formed in the viewing-area periphery with the metal thin film. Furthermore, the manufacture approach of the liquid crystal panel characterized by having the glass substrate lamination process which irradiates ultraviolet rays to two substrates from the both sides of lamination and two substrates, and hardens seal resin after the liquid crystal ingredient of the specified quantity is dropped at the viewing area of one of substrates.

[Claim 4] The manufacture approach of the liquid crystal panel according to claim 3 characterized by for the width of face of the drawer electrode of a field which laps with ultraviolet curing mold seal resin being 40 micrometers or less, and being 3.0 or less times of distance with the drawer electrode which adjoins further.

[Claim 5] Ultraviolet curing mold seal resin is applied to the viewing-area periphery of either substrate of the glass substrate which has the drawer electrode formed with the metal thin film, and the glass substrate which has the light-shielding film made of resin which contained the black pigment in the viewing-area periphery. Furthermore, the manufacture approach of the liquid crystal panel characterized by having the glass substrate lamination process which irradiates ultraviolet rays from the glass substrate side which has superposition and a metal drawer electrode for two substrates, and hardens seal resin after the liquid crystal ingredient of the specified quantity is dropped at the viewing area of one of substrates.

[Claim 6] The manufacture approach of the liquid crystal panel according to claim 5 characterized by for the width of face of the drawer electrode of a field which laps with ultraviolet curing mold seal resin being 30 micrometers or less, and being 2.0 or less times of distance with the drawer electrode which adjoins further.

[Claim 7] Ultraviolet curing mold seal resin is applied to the viewing-area periphery of either substrate of the glass substrate which has the drawer electrode formed with the metal thin film, and the glass substrate which has the light-shielding film made of resin which contained the black pigment in the viewing-area periphery. Furthermore, the manufacture approach of the liquid crystal panel characterized

by having the glass substrate lamination process which irradiates ultraviolet rays to two substrates from the both sides of lamination and two substrates, and hardens seal resin after the liquid crystal ingredient of the specified quantity is dropped at the viewing area of one of substrates.
[Claim 8] The manufacture approach of the liquid crystal panel according to claim 7 characterized by for the width of face of the drawer electrode of a field which laps with ultraviolet curing mold seal resin being 30 micrometers or less, and being 2.5 or less times of distance with the drawer electrode which adjoins further.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a liquid crystal panel, and relates to the lamination approach of two glass substrates which sandwich liquid crystal especially.
[0002]
[Description of the Prior Art] A Prior art is explained using drawing 9 - drawing 12 . The assembly approach of a liquid crystal panel is roughly classified, and two kinds of methods of construction are proposed.
[0003] After first assembling an empty cel as the 1st method of construction stuck a glass substrate and shown in drawing 9 - drawing 11 , it is the approach of carrying out vacuum suction of the inside of an empty cel, and pouring in a liquid crystal ingredient using the differential pressure of the vaccum pressure in an empty cel, and atmospheric pressure (vacuum grouting). In the case of vacuum grouting, after sticking the glass substrate 1 of two upper and lower sides and fully hardening seal resin 8, a liquid crystal ingredient is poured in. As an ingredient of seal resin 8, a heat-curing mold and an ultraviolet curing mold can be chosen as arbitration according to a panel configuration.
[0004] Although the configuration in which seal resin 8 laps with the light-shielding film 2 of a viewing-area periphery as shown in drawing 9 and drawing 10 to the demand of space-saving-izing of a liquid crystal panel is in use in recent years, when the seal resin of a heat-curing mold is used, are concerned, there is nothing to physical relationship with a light-shielding film 2, and seal resin 8 can fully be hardened. Most produced liquid crystal panels are assembled by this vacuum grouting by current, and it is the method of construction with which condition examination progressed most.
[0005] The 2nd method of construction is a method of construction (dropping method of construction) which sticks another substrate, after trickling a liquid crystal ingredient on one substrate. Since the throughput of panel creation is short and the use effectiveness of a liquid crystal ingredient is also high, this method of construction is expected as a next-generation erector method.
[0006] However, in order to be easy to generate turbulence of liquid crystal orientation in order that a

liquid crystal ingredient may contact non-hardened seal resin directly, and to stabilize liquid crystal orientation as much as possible, the seal resin ingredient of the ultraviolet curing mold which can be hardened quickly is used.

[0007]

[Problem(s) to be Solved by the Invention] When manufacturing a liquid crystal panel with a dropping method of construction, the seal resin of an ultraviolet curing mold is used as mentioned above, but constraint is needed for a design and the UV irradiation approach of the viewing-area periphery of a panel so that the ultraviolet rays of sufficient energy can be irradiated at seal resin at this time.

[0008] the liquid crystal panel using metal drawer electrodes, such as a reflective mold liquid crystal panel using reflection especially by a TFT-liquid-crystal panel and an electrode, -- one of the upper and lower sides of a panel -- UV irradiation -- even if it carries out, the field which cannot irradiate ultraviolet rays occurs to seal resin, hardening [of seal resin] becomes inadequate near [this] the field, and liquid crystal orientation is not stabilized.

[0009] For this reason, in order to create the liquid crystal panel in which the drawer electrode was formed with the metal using the dropping method of construction, as shown in drawing 12 R> 2, it is necessary to apply ultraviolet curing mold seal resin 81 outside further, and to irradiate ultraviolet rays 90 through the ultraviolet-rays protection-from-light mask 91 from the substrate side with a light-shielding film 2 of the light-shielding film 2 of a viewing-area periphery. Since it became the shade of the metal drawer electrode 42 or a light-shielding film 2 about seal resin in a configuration of making a boundary region space-saving in piles, the problem that seal resin 8 could not fully be hardened was in the light-shielding film 2 of a viewing-area periphery as shown in drawing 9 and drawing 10 .

[0010]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it is effective to prepare a limit in distance (the field in which an electrode is not formed: inter-electrode width of face) with the electrode which adjoins drawer electrode width of face for every quality of the material of a light-shielding film, and to irradiate ultraviolet rays from the substrate side which has a drawer electrode, or to irradiate ultraviolet rays from the both sides of two stuck substrates.

[0011] Thus, by preparing constraint in the design of drawer electrode width of face and drawer inter-electrode width of face The ultraviolet rays which carried out incidence into seal resin from inter-electrode by reflection in the light-shielding film front face of an opposite substrate, the multiple echo by the light-shielding film front face and the electrode surface, and dispersion according to the filler agent in a sealing material further The shade field of an electrode can also fully be irradiated, and the chain reaction of the photoinitiator in seal resin also occurs, and the seal resin of the shade field of an electrode can fully be hardened.

[0012]

[Embodiment of the Invention] Drawing 1 - drawing 6 show the cross section for the principal part of the TFT-liquid-crystal panel in the gestalt of operation of this invention. 1 a metal drawer electrode substrate and 14 for a glass substrate and 13 here A protection-from-light substrate, The light-shielding film of metal [21], the light-shielding film of the product [22] made of resin, and 31, 32 and 33, respectively Red, green, a blue color filter, the drawer electrode of metal [41 / 42 / a transparent electrode (ITO) and], and 5 -- for a liquid crystal ingredient and 71, as for ultraviolet curing mold seal resin and 90, a spacer particle and 81 are [an overcoat and 6 / the orientation film and 7 / ultraviolet rays and 91] ultraviolet-rays protection-from-light masks.

[0013] Drawing 1 - drawing 3 are the cases where the light-shielding film made of resin in which drawing 4 - drawing 6 contained the black pigment as a light-shielding film 22, using metal thin films, such as Cr, as a light-shielding film 21 is used. Moreover, drawing 1 - drawing 6 show the case where the exposure of ultraviolet rays 90 is irradiated from the drawer electrode substrate 13 side, and the case where it irradiates from the both sides of the drawer electrode substrate 13 and the protection-from-light substrate 14, using each sectional view.

[0014] It changes to drawer electrode width of face and inter-electrode width of face (width of face of the field in which the electrode inter-electrode [adjoining] is not formed) with the quality of the material of a light-shielding film, and approaches (from both the substrates 13 side from the drawer electrode substrate 13 side, and 14 sides) of UV irradiation, and as shown in (Table 4), it is restricted to them.
[0015] Moreover, if the exposure of ultraviolet rays is more than fixed energy, most things for which the amount of UV irradiation energy affects the above-mentioned limit cannot be found.
[0016] Next, the concrete example of this invention is explained using drawing 7 R> 7, drawing 8 , (Table 1), (Table 2-1), (Table 2-2), (Table 3), and (Table 4).
[0017] (Example 1) The photoresist was applied to the glass substrate [finishing / Cr film deposition], and drawing 7 and (Table 1) shown Cr pattern substrate 10 of A-O were created through processes, such as UV irradiation through a photo mask, development, etching, and resist exfoliation. This Cr pattern has composition (simulation drawer electrode 43) which imitated the metal drawer electrode, and when performing ultraviolet curing for performing seal resin hardening at a back process, it is formed in order to make the field equivalent to the shade of a drawer electrode. The simulation electrode width of face 431 and the inter-electrode width of face 432 of this A-O are as being shown in (Table 1).
[0018]
[Table 1]

[0019] Spreading, 200 degrees C, and heat curing of 2 hours were given for the heat-curing mold resin which uses a spin coater for these Cr pattern substrates 10, and consists of an epoxy resin, and the overcoat 5 was formed. next, FOTORISO after forming a transparent electrode (ITO) 41 by sputtering so that it may become 2000-2500A thickness on the whole surface -- patterning was performed in the shape of a stripe in law, and the segment substrate 11 for STN liquid crystal panels was created (refer to drawing 8).
[0020] After forming the orientation film 6 made of polyimide resin in the front face of these segment substrates 11 and the color filter substrate 12 with the common pattern of ITO prepared beforehand so that it may become 500-1000A thickness, rubbing processing was performed in the predetermined direction so that it might be assembled as a STN liquid crystal panel. The light-shielding film 2 is formed in this color filter substrate 12, and this light-shielding film prepared two kinds with the thing made from Cr, and the thing containing a black pigment made of resin.
[0021] Next, the ultraviolet curing mold epoxy acrylate system seal resin 81 which contained glass fiber of 7.0 micrometers of mean diameters in the viewing-area periphery of these segment substrates 11 1 to 2% was applied by screen-stencil, and the liquid crystal ingredient 7 of the specified quantity was further dropped at the viewing area. At this time, seal resin 81 was formed so that it might lap with the pattern of the simulation drawer electrode 43 formed by Cr, and so that a viewing area might be surrounded.
[0022] On the other hand, to the color filter substrate 12, 200-300 spacer particles 71 per square millimeter with a mean particle diameter of 6.5 micrometers made of resin with fixing material were

sprinkled, 150 heat treatments were performed, and it fixed to the substrate.

[0023] Next, after seal resin 81 took out these segment substrates 11 and color filter substrates 12 from lamination and a vacuum chamber in the vacuum chamber so that only one half might lap with the viewing-area periphery side light-shielding film 2 of the color filter substrate 12, the STN liquid crystal panel which irradiates seal resin 81 and shows ultraviolet rays 90 to it at drawing 8 was created. At this time, the exposure of ultraviolet rays 90 created, respectively what irradiated 25 mW/cm2 (it measures in 405nm) from the both sides of the thing and the segment substrate 11 to which it carried out for 5 minutes, and which were irradiated from the segment substrate 11 side, and the color filter substrate 12.

[0024] After giving 130-degree C heat annealing to these STN liquid crystal panels for 30 hours, electrical-potential-difference impression was carried out at the panel, and the stability of the orientation of liquid crystal was observed. An observation result is shown in (Table 2-1) and (Table 2-2).

[0025] Next, the panel of these created A-O was disassembled, seal resin 81 was removed, FTIR analysis was performed, and the polymerization degree of seal resin was measured. A measurement result is shown in (Table 2-1) and (Table 2-2).

[0026]

[Table 2-1]

[0027]

[Table 2-2]

[0028] (Example 2) The STN liquid crystal panel of drawing 8 was created like the example 1 among Cr pattern substrates 10 created in the example 1 using A and M (for Cr and resin, a light-shielding film 2 is). Under the present circumstances, UV irradiation time amount at the time of hardening of seal resin 81 was made into 1, 2, 3, 5, and 10 minutes, and the exposure was performed from the segment substrate side. After giving 140 degrees C and heat annealing of 30 hours to these panels and evaluating

the stability of liquid crystal orientation, the panel was disassembled and polymerization degree was measured for each seal resin in FTIR analysis. This result is shown in (Table 3).
[0029]
[Table 3]

[0030] (Table 2-1) and (Table 2-2) show the degree of hardening of ultraviolet curing mold seal resin 81 changing with the electrode width of face 431 of the metal simulation drawer electrode 43, and inter-electrode width of face 432, and changing with the quality of the materials and the UV irradiation approaches (from which glass substrate side does it irradiate?) of a light-shielding film 2 of the color filter substrate 12. It is thought that all the ultraviolet rays that this irradiated are because the seal resin 81 of the field which is reflected by the simulation electrode 43 made from a light-shielding film 2 metallurgy group, and serves as shade of the simulation electrode 43 or a light-shielding film 2 also irradiates since incidence is not carried out at right angles to a substrate side with parallel light and many slanting light is also contained.
[0031] As for (Table 3), when ultraviolet-rays smallness exposure energy is more than constant value (25 mW/cm 2 or 3 minutes), ultraviolet-rays smallness exposure energy shows that there is almost no effect in whenever [electrode width-of-face 431, inter-electrode width-of-face 432, and seal hardening].
[0032] From these results, the design condition of the drawer electrode in the case of assembling the liquid crystal panel using a metal drawer electrode using UV irradiation mold seal resin is determined, as shown in (Table 4).
[0033]
[Table 4]

[0034] In addition, at this example, in order to check the stability of liquid crystal orientation, when hardening of seal resin was inadequate, liquid crystal orientation used turbulence and a cone STN liquid crystal panel under the effect, but the same hardening is obtained even if it is the liquid crystal panel of TN mode and others.
[0035] Based on these results, the TFT-liquid-crystal panel (drawing 1 - drawing 6) was created as

the condition shown in (Table 4), and it checked that it was the good panel of the display by which liquid crystal orientation was stabilized. In addition, in these drawings, since it was easy, to this invention, the illustration of a part which is not directly related omitted the TFT array etc.

[0036]

[Effect of the Invention] Even if it uses a dropping method of construction by preparing constraint in the electrode width of face of a metal drawer electrode, and inter-electrode width of face, the viewing-area periphery by which liquid crystal orientation was stabilized can manufacture a compact liquid crystal panel.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a metal light-shielding film, and seal resin irradiates a one half lap and ultraviolet rays to it from a drawer electrode substrate side)

[Drawing 2] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a metal light-shielding film, and seal resin irradiates a one half lap and ultraviolet rays at it from the both sides of a drawer electrode substrate and a protection-from-light substrate)

[Drawing 3] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a metal light-shielding film, seal resin all laps with it, and ultraviolet rays are irradiated from a drawer electrode substrate side)

[Drawing 4] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a light-shielding film made of resin, and seal resin irradiates a one half lap and ultraviolet rays to it from a drawer electrode substrate side)

[Drawing 5] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a light-shielding film made of resin, and seal resin irradiates a one half lap and ultraviolet rays at it from the both sides of a drawer electrode substrate and a protection-from-light substrate)

[Drawing 6] The sectional view for the principal part of the liquid crystal panel in the gestalt of operation of this invention (a light-shielding film is a light-shielding film made of resin, seal resin all laps with it, and ultraviolet rays are irradiated from a drawer electrode substrate side)

[Drawing 7] The top view for the principal part of the simulation electrode pattern used in the concrete example of this invention

[Drawing 8] The sectional view for the principal part of the STN liquid crystal panel created in the concrete example of this invention

[Drawing 9] The sectional view for the principal part of the liquid crystal panel assembled with vacuum grouting in the conventional technique (seal resin all laps with a light-shielding film)
[Drawing 10] the sectional view for the principal part of the liquid crystal panel assembled with vacuum grouting in the conventional technique (seal resin -- a light-shielding film -- one half -- a pile)
[Drawing 11] The sectional view for the principal part of the liquid crystal panel assembled with vacuum grouting in the conventional technique (seal resin does not lap with a light-shielding film)
[Drawing 12] The sectional view for the principal part of the liquid crystal panel assembled with the liquid crystal dropping method of construction in the conventional technique (seal resin does not lap with a light-shielding film, but ultraviolet rays are irradiated from a protection-from-light substrate side)
[Description of Notations]
1 Glass Substrate
2 Light-shielding Film
5 Overcoat
6 Orientation Film
7 Liquid Crystal Ingredient
8 Seal Resin
10 Cr Pattern Substrate
11 Segment Substrate
12 Color Filter Substrate
13 Drawer Electrode Substrate
14 Protection-from-Light Substrate
21 Metal Light-shielding Film
22 Light-shielding Film made of Resin
31 Color Filter (Red)
32 Color Filter (Green)
33 Color Filter (Blue)
41 Transparent Electrode (ITO)
42 Drawer Electrode
43 Simulation Drawer Electrode
71 Spacer Particle
81 Ultraviolet Curing Mold Seal Resin
90 Ultraviolet Rays
91 Ultraviolet-Rays Protection-from-Light Mask
431 Electrode Width of Face
432 Inter-electrode Width of Face

[Translation done.]

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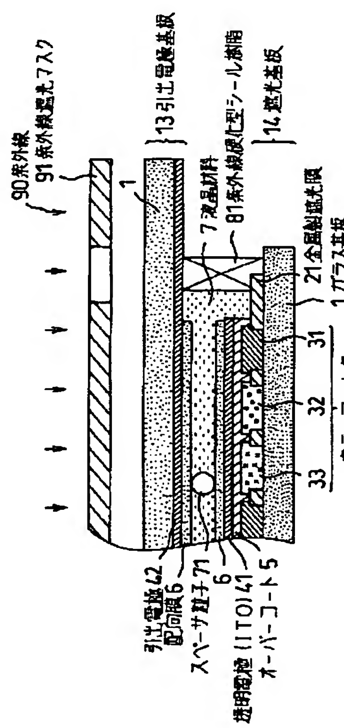
(54)【発明の名称】 液晶パネルの製造方法

(57)【要約】
【課題】 液晶滴下工法による液晶パネルの製造方法で、引出電極基板と遮光基板とを接着する紫外線硬化型樹脂を十分に硬化し、配向異常のない表示品位の良好なパネルを製造する。

【解決手段】 金属薄膜で形成された引出電極４２を有するガラス基板１と、表示領域周辺部に遮光膜２１を有するガラス基板１の、どちらか一方の基板の表示領域周辺部に紫外線硬化型シール樹脂８１を形成し、更にどちらか一方の基板の表示領域に所定量の液晶材料７を滴下した後、２枚の基板を重ね合わせて、金属製引出電極４２を有するガラス基板側、または２枚の基板の両側から紫外線を照射してシール樹脂を硬化する。



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【特許請求の範囲】

【請求項１】　金属薄膜で形成された引出電極を有するガラス基板と、表示領域周辺部に金属薄膜で形成された遮光膜を有するガラス基板のいずれか一方の基板の表示領域周辺部に紫外線硬化型シール樹脂を塗布し、更にいずれか一方の基板の表示領域に所定量の液晶材料を滴下した後、２枚の基板を重ね合わせ、金属製引出電極を有するガラス基板側から紫外線を照射してシール樹脂を硬化するガラス基板貼り合わせ工程を有することを特徴とする液晶パネルの製造方法。

【請求項２】　紫外線硬化型シール樹脂と重なる領域の引出電極の幅が４０μm以下であり、更に隣接する引出電極との距離の２．５倍以下であることを特徴とする請求項１記載の液晶パネルの製造方法。

【請求項３】　金属薄膜で形成された引出電極を有するガラス基板と、表示領域周辺部に金属薄膜で形成された遮光膜を有するガラス基板のいずれか一方の基板の表示領域周辺部に紫外線硬化型シール樹脂を塗布し、更にいずれか一方の基板の表示領域に所定量の液晶材料を滴下した後、２枚の基板を貼り合わせ、２枚の基板の両側から紫外線を照射してシール樹脂を硬化するガラス基板貼り合わせ工程を有することを特徴とする液晶パネルの製造方法。

【請求項４】　紫外線硬化型シール樹脂と重なる領域の引出電極の幅が４０μm以下であり、更に隣接する引出電極との距離の３．０倍以下であることを特徴とする請求項３記載の液晶パネルの製造方法。

【請求項５】　金属薄膜で形成された引出電極を有するガラス基板と、表示領域周辺部に黒色顔料を含んだ樹脂製の遮光膜を有するガラス基板のいずれか一方の基板の表示領域周辺部に紫外線硬化型シール樹脂を塗布し、更にいずれか一方の基板の表示領域に所定量の液晶材料を滴下した後、２枚の基板を重ね合わせ、金属製引出電極を有するガラス基板側から紫外線を照射してシール樹脂を硬化するガラス基板貼り合わせ工程を有することを特徴とする液晶パネルの製造方法。

【請求項６】　紫外線硬化型シール樹脂と重なる領域の引出電極の幅が３０μm以下であり、更に隣接する引出電極との距離の２．０倍以下であることを特徴とする請求項５記載の液晶パネルの製造方法。

【請求項７】　金属薄膜で形成された引出電極を有するガラス基板と、表示領域周辺部に黒色顔料を含んだ樹脂製の遮光膜を有するガラス基板のいずれか一方の基板の表示領域周辺部に紫外線硬化型シール樹脂を塗布し、更にいずれか一方の基板の表示領域に所定量の液晶材料を滴下した後、２枚の基板を貼り合わせ、２枚の基板の両側から紫外線を照射してシール樹脂を硬化するガラス基板貼り合わせ工程を有することを特徴とする液晶パネルの製造方法。

【請求項８】　紫外線硬化型シール樹脂と重なる領域の

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引出電極の幅が３０μm以下であり、更に隣接する引出電極との距離の２．５倍以下であることを特徴とする請求項７記載の液晶パネルの製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、液晶パネルの製造方法に係り、特に、液晶を挟む二枚のガラス基板の貼り合わせ方法に関するものである。

【０００２】

【従来の技術】従来の技術について図９～図１２を用いて説明する。液晶パネルの組立方法は大きく分類して２通りの工法が提案されている。

【０００３】まず第１の工法は、ガラス基板を貼り合わせて図９～図１１に示すような空セルを組み立てた後に、空セル内を真空引きし、空セル内の真空圧と大気圧の圧力差を利用して液晶材料を注入する方法である（真空注入工法）。真空注入工法の場合には、上下２枚のガラス基板１を貼り合わせて、シール樹脂８を十分に硬化した後、液晶材料を注入する。シール樹脂８の材料として、パネル構成に応じて熱硬化型と紫外線硬化型を任意に選択することができる。

【０００４】近年、液晶パネルの省スペース化の要求に対して、図９，図１０に示すような表示領域周辺部の遮光膜２にシール樹脂８が重なる構成が主流であるが、熱硬化型のシール樹脂を用いた場合には遮光膜２との位置関係に関わりなく、シール樹脂８を十分に硬化することができる。現在までに生産された液晶パネルのほとんどがこの真空注入工法により組み立てられており、最も条件検討が進んだ工法である。

【０００５】第２の工法は、液晶材料を一方の基板上に滴下した後、もう一方の基板を貼り合わせる工法（滴下工法）である。この工法はパネル作成のスループットが短く、液晶材料の利用効率も高いことから次世代の組立工法として期待されている。

【０００６】しかし、未硬化のシール樹脂に液晶材料が直接接触するために液晶配向の乱れが発生しやすく、できるだけ液晶配向を安定させるために、迅速に硬化することのできる紫外線硬化型のシール樹脂材料が用いられている。

【０００７】

【発明が解決しようとする課題】滴下工法により液晶パネルを製造する時には、上記のように紫外線硬化型のシール樹脂が用いられているが、この時十分なエネルギーの紫外線をシール樹脂に照射できるようにパネルの表示領域周辺部の設計及び紫外線照射方法に制約が必要となる。

【０００８】特にＴＦＴ液晶パネルや電極による反射を用いた反射型液晶パネル等の、金属製の引出電極を用いた液晶パネルでは、パネルの上下いずれから紫外線照射を行ってもシール樹脂に紫外線を照射することができな

い領域が発生し、この領域近傍ではシール樹脂の硬化が不十分となり、液晶配向が安定しない。

【0009】このため滴下工法を用いて金属により引出電極が形成された液晶パネルを作成するためには、図12に示すように、表示領域周辺部の遮光膜2の更に外側に紫外線硬化型シール樹脂81を塗布して、遮光膜2のある基板側から紫外線遮光マスク91を通して紫外線90の照射を行う必要がある。図9，図10に示すような表示領域周辺部の遮光膜2にシール樹脂を重ねて、周辺領域を省スペース化する構成の場合には、金属製の引出電極42又は遮光膜2の陰となるために、シール樹脂8を十分に硬化することができないという問題があった。

【0010】

【課題を解決するための手段】上記課題を解決するために、遮光膜の材質毎に引出電極幅と、隣接する電極との距離（電極の形成されていない領域：電極間幅）に制限を設けて、引出電極を有する基板側から紫外線を照射することや、貼り合わせた2枚の基板の両側から紫外線を照射することが効果的である。

【0011】このように、引出電極幅と引出電極間幅の設計に制約を設けることによって、電極間からシール樹脂中に入射した紫外線を、対向基板の遮光膜表面での反射や遮光膜表面と電極表面による多重反射、更にはシール材料中のフィラー剤による散乱により、電極の陰領域にも十分に照射することができ、また、シール樹脂中の光開始剤の連鎖反応もあって、電極の陰領域のシール樹脂を十分に硬化することができる。

【0012】

【発明の実施の形態】図1～図6は本発明の実施の形態におけるTFT液晶パネルの主要部分の断面を示したものである。ここで、1はガラス基板、13は金属製の引出電極基板、14は遮光基板、21は金属製の遮光膜、22は樹脂製の遮光膜、31，32，33はそれぞれ赤，緑，青のカラーフィルタ、41は透明電極（IT＊O）、42は金属製の引出電極、5はオーバーコート、6は配向膜、7は液晶材料、71はスペーサー粒子、81は紫外線硬化型シール樹脂、90は紫外線、91は紫外線遮光マスクである。

【0013】図1～図3は遮光膜21としてCr等の金属薄膜を用い、図4～図6は遮光膜22として黒色顔料を含んだ樹脂製の遮光膜を用いた場合である。また図1～図6は、それぞれの断面図を用いて、紫外線90の照射を引出電極基板13側から照射した場合と、引出電極基板13と遮光基板14の両側から照射した場合を示している。

【0014】引出電極幅と、電極間幅（隣接する電極間の、電極が形成されていない領域の幅）には、遮光膜の材質と紫外線照射の方法（引出電極基板13側からか、両基板13、14側からか）によって異なり、（表4）のように制限されている。

【0015】また、紫外線の照射が一定エネルギー以上であれば、紫外線照射エネルギー量が上記制限に影響を及ぼすことはほとんど無い。

【0016】次に、本発明の具体的実施例について図7，図8，（表1），（表2－1），（表2－2），（表3），（表4）を用いて説明する。

【0017】（実施例1）Cr着膜済みのガラス基板にフォトレジストを塗布、フォトマスクを介しての紫外線照射、現像、エッチング、レジスト剥離等の工程を経て、図7及び（表1）に示すA～OのCrパターン基板10を作成した。このCrパターンは金属製の引出電極を模した構成（模擬引出電極43）となっており、後工程でシール樹脂硬化を行うための紫外線硬化を行う時に、引出電極の陰に相当する領域を作り出すために形成したものである。このA～Oの模擬電極幅431と、電極間幅432は（表1）に示す通りである。

【0018】

【表1】

パターン	電極幅（μm）	電極間幅（μm）	電極幅／電極間
A	5	10	0.5
B	10	10	1.0
C	15	10	1.5
D	20	10	2.0
E	25	10	2.5
F	30	10	3.0
G	40	10	4.0
H	20	20	1.0
I	30	20	1.5
J	40	20	2.0
K	30	30	1.0
L	60	30	2.0
M	40	40	1.0
N	80	40	2.0
O	50	50	1.0

【0019】これらのCrパターン基板10にスピンコーターを用いてエポキシ樹脂からなる熱硬化型樹脂を塗布、200℃，2時間の熱硬化を施してオーバーコート5を形成した。次に、スパッタリングによって透明電極（ITO）41を全面に2000～2500Åの膜厚となるように成膜した後、フォトリソ法にてストライプ状にパターニングを行い、STN液晶パネル用のセグメント基板11を作成した（図8参照）。

【0020】これらのセグメント基板11と、予め準備しておいたITOのコモンパターン付のカラーフィルタ

基板１２の表面に、ポリイミド樹脂製の配向膜６を５００～１０００Åの膜厚となるように形成した後、ＳＴＮ液晶パネルとして組み立てられるように、所定の方向にラビング処理を行った。このカラーフィルタ基板１２には遮光膜２が形成されており、この遮光膜がＣｒ製のものと、黒色顔料を含んだ樹脂製のものと２通り準備した。

【００２１】次に、これらのセグメント基板１１の表示領域周辺部に、平均粒径７．０μmのガラスファイバーを１～２％含んだ紫外線硬化型エポキシアクリレート系シール樹脂８１をスクリーン印刷によって塗布し、更に、表示領域には所定量の液晶材料７を滴下した。この時シール樹脂８１はＣｒによって形成した模擬引出電極４３のパターンに重なるように、かつ表示領域を取り囲むように形成した。

【００２２】一方、カラーフィルタ基板１２には平均粒径６．５μmの固着材付樹脂製のスペーサ粒子７１を平方ミリメートル当たり２００～３００個散布し、１５０度の熱処理を施して基板に固着した。

【００２３】次に、真空チャンバー中でこれらのセグメント基板１１とカラーフィルタ基板１２を、シール樹脂８１がカラーフィルタ基板１２の表示領域外周辺遮光膜２に半分だけ重なるように貼り合わせ、真空チャンバーから取り出した後にシール樹脂８１に紫外線９０を照射して、図８に示すＳＴＮ液晶パネルを作成した。この時紫外線９０の照射は２５mW／ｃm^2（４０５nmにて測定）を５分間行い、セグメント基板１１側から照射したものとセグメント基板１１とカラーフィルタ基板１２の両側から照射したものをそれぞれ作成した。

【００２４】これらのＳＴＮ液晶パネルに１３０℃の熱アニールを３０時間施した後にパネルに電圧印加して液晶の配向の安定性を観察した。観察結果を（表２－１），（表２－２）に示す。

【００２５】次に、これらの作成したＡ～Ｏのパネルを分解して、シール樹脂８１を剥がして、ＦＴＩＲ解析を行い、シール樹脂の重合度を測定した。測定結果を（表２－１），（表２－２）に示す。

【００２６】

【表２－１】

パターン	遮光膜	配向性		重合度	
		ＵＶ片側	ＵＶ両側	ＵＶ片側	ＵＶ両側
A	Cr	○	○	82.1	83.3
B	Cr	○	○	80.3	81.1
C	Cr	○	○	81.2	79.8
D	Cr	○	○	78.0	79.2
E	Cr	○	○	76.3	78.8
F	Cr	△～○	○	71.3	77.2
G	Cr	×	△	69.8	72.6
H	Cr	○	○	80.9	82.2
I	Cr	○	○	80.1	80.0
J	Cr	○	○	78.8	79.2
K	Cr	○	○	79.9	81.1
L	Cr	×	×	45.3	50.8
M	Cr	○	○	77.6	78.2
N	Cr	×	×	43.1	51.2
O	Cr	×	×	58.6	64.2

【００２７】

【表２－２】

パターン	遮光膜	配向性		重合度	
	材料	ＵＶ片側	ＵＶ両側	ＵＶ片側	ＵＶ両側
A	樹脂	○	○	79.8	80.6
B	樹脂	○	○	77.9	78.6
C	樹脂	○	○	78.1	78.0
D	樹脂	○	○	75.3	77.8
E	樹脂	△～○	○	73.3	76.9
F	樹脂	△	△～○	66.0	71.4
G	樹脂	×	×	58.8	64.2
H	樹脂	○	○	79.3	78.2
I	樹脂	○	○	76.8	78.4
J	樹脂	×	×	53.4	65.3
K	樹脂	○	○	76.3	77.7
L	樹脂	×	×	34.1	47.2
M	樹脂	×	△	59.3	67.7
N	樹脂	×	×	33.4	32.1
O	樹脂	×	×	48.8	59.9

【００２８】（実施例２）実施例１で作成したＣｒパターン基板１０のうち、Ａ，Ｍ（遮光膜２がＣｒ、樹脂共）を用いて実施例１と同様に図８のＳＴＮ液晶パネルを作成した。この際、シール樹脂８１の硬化時の紫外線照射時間を１，２，３，５，１０分とし、照射はセグメント基板側から行った。これらのパネルに１４０℃、３０時間の熱アニールを施して液晶配向の安定性を評価した後に、パネルを分解して、それぞれのシール樹脂をＦＴＩＲ解析によって重合度を測定した。この結果を（表３）に示す。

【0029】

【表3】

パターン	遮光膜	照射時間(分)	配向性	重合度
A	Cr	1	×	55.4
A	Cr	2	△~○	72.3
A	Cr	3	○	81.1
A	Cr	5	○	82.1
A	Cr	10	○	81.9
M	Cr	1	×	52.2
M	Cr	2	△~○	69.3
M	Cr	3	○	76.9
M	Cr	5	○	77.6
M	Cr	10	○	78.2
A	樹脂	1	×	51.2
A	樹脂	2	△~○	70.3
A	樹脂	3	○	78.8
A	樹脂	5	○	79.8
A	樹脂	10	○	78.2
M	樹脂	1	×	43.1
M	樹脂	2	×	51.1
M	樹脂	3	×	59.3
M	樹脂	5	×	59.3
M	樹脂	10	×	60.0

【0030】（表２－１），（表２－２）から、金属製模擬引出電極４３の電極幅４３１、電極間幅４３２によって紫外線硬化型シール樹脂８１の硬化の度合が異なり、カラーフィルタ基板１２の遮光膜２の材質と紫外線照射方法（どちらのガラス基板側から照射するか）によって異なっていることがわかる。これは、照射した紫外線は、すべて平行光で基板面に垂直に入射している訳ではなく、斜め光も多く含まれているために、遮光膜２や金属製模擬電極４３によって反射されて模擬電極４３や遮光膜２の陰となっている領域のシール樹脂８１にも照射されるためであると考えられる。

【0031】（表３）は、紫外線小照射エネルギーが一定値（２５mW／cm^2，３分）以上の場合には、紫外線小照射エネルギーは電極幅４３１、電極間幅４３２とシール硬化度にはほとんど影響がないことを示している。

【0032】これらの結果から、金属製の引出電極を用いた液晶パネルを紫外線照射型シール樹脂を用いて組み立てる場合の引出電極の設計条件が（表４）のように決定される。

【0033】

【表4】

対向遮光層	UV照射方向	電極幅（μm）	電極幅／電極間幅
金属	片側	≦40	≦2.5
金属	両側	≦40	≦3.0
樹脂	片側	≦30	≦2.0
樹脂	両側	≦30	≦2.5

【0034】なお、本実施例では液晶配向の安定性を確認するために、シール樹脂の硬化が不十分な場合に、その影響で液晶配向が乱れやすいＳＴＮ液晶パネルを用いたが、ＴＮモードその他の液晶パネルであっても、同様の硬化が得られる。

【0035】これらの結果をもとに、（表４）に示す条件通りにＴＦＴ液晶パネル（図１～図６）を作成し、液晶配向の安定した表示の良好なパネルであることを確認した。なお、これらの図では簡単のためにＴＦＴアレイ等、本発明には直接関係しない部分の図示は省略した。

【0036】

【発明の効果】金属製引出電極の電極幅、電極間幅に制約を設けることによって、滴下工法を用いても、液晶配向が安定した表示領域周辺部がコンパクトな液晶パネルを製造することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が金属製遮光膜で、それにシール樹脂が半分重なり、紫外線は引出電極基板側から照射）

【図２】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が金属製遮光膜で、それにシール樹脂が半分重なり、紫外線は引出電極基板及び遮光基板の両側から照射）

【図３】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が金属製遮光膜で、それにシール樹脂が全部重なり、紫外線は引出電極基板側から照射）

【図４】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が樹脂製遮光膜で、それにシール樹脂が半分重なり、紫外線は引出電極基板側から照射）

【図５】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が樹脂製遮光膜で、それにシール樹脂が半分重なり、紫外線は引出電極基板及び遮光基板の両側から照射）

【図６】本発明の実施の形態における液晶パネルの主要部分の断面図（遮光膜が樹脂製遮光膜で、それにシール樹脂が全部重なり、紫外線は引出電極基板側から照射）

【図７】本発明の具体的実施例で用いた模擬電極パターンの主要部分の平面図

【図８】本発明の具体的実施例で作成したＳＴＮ液晶パネルの主要部分の断面図

【図９】従来技術における真空注入工法により組み立てた液晶パネルの主要部分の断面図（シール樹脂が遮光膜に全部重なる）

【図１０】従来技術における真空注入工法により組み立てた液晶パネルの主要部分の断面図（シール樹脂が遮光膜に半分重なる）

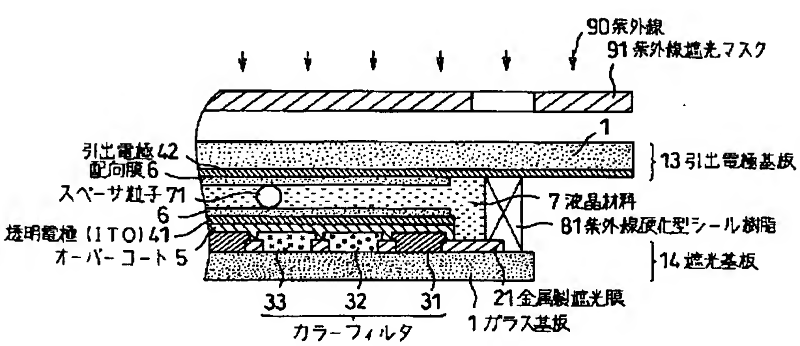
【図１１】従来技術における真空注入工法により組み立てた液晶パネルの主要部分の断面図（シール樹脂が遮光膜に重ならない）

【図１２】従来技術における液晶滴下工法により組み立てた液晶パネルの主要部分の断面図（シール樹脂が遮光膜に重ならず、紫外線は遮光基板側から照射）

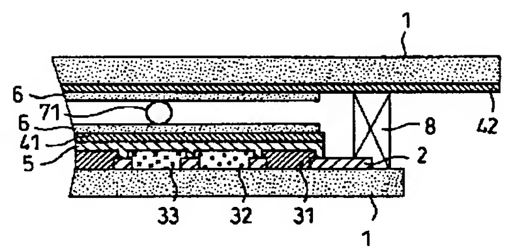
【符号の説明】

1　　ガラス基板
2　　遮光膜
5　　オーバーコート
6　　配向膜
7　　液晶材料
8　　シール樹脂
１０　Ｃｒパターン基板
１１　セグメント基板
１２　カラーフィルタ基板
１３　引出電極基板
１４　遮光基板
２１　金属製遮光膜
２２　樹脂製遮光膜
３１　カラーフィルタ（赤）
３２　カラーフィルタ（緑）
３３　カラーフィルタ（青）
４１　透明電極（ＩＴＯ）
４２　引出電極
４３　模擬引出電極
７１　スペーサ粒子
８１　紫外線硬化型シール樹脂
９０　紫外線
９１　紫外線遮光マスク
４３１　電極幅
４３２　電極間幅

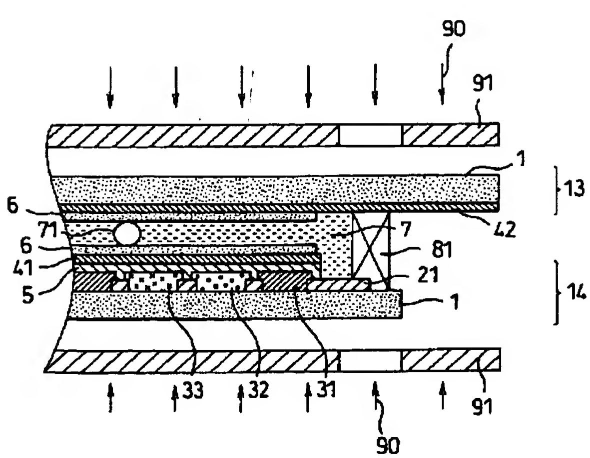
【図１】



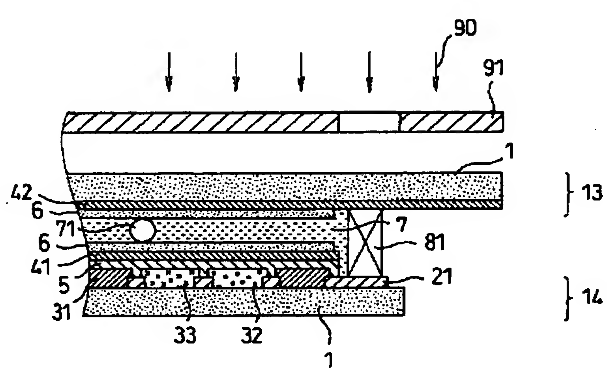
【図１０】



【図２】



【図３】



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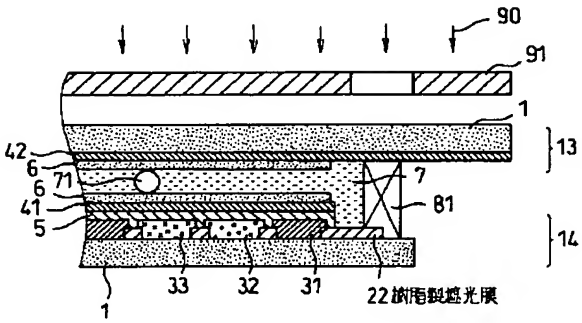
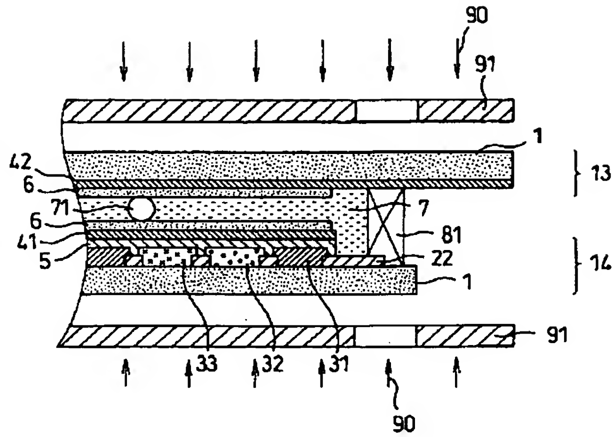
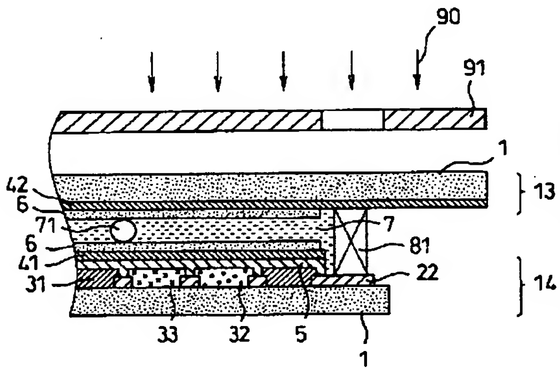


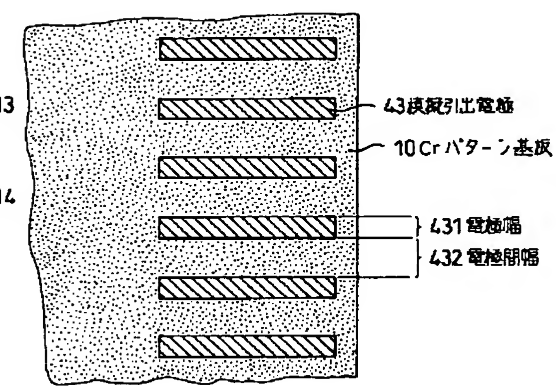
【図5】



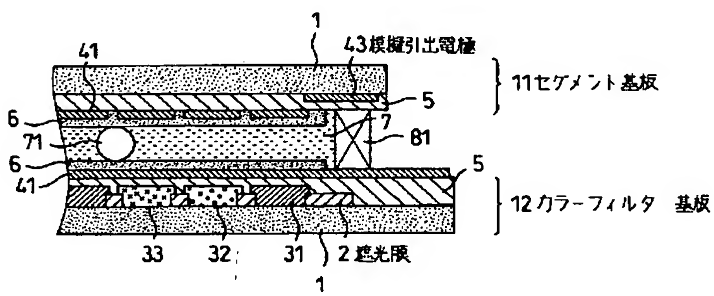
【図6】



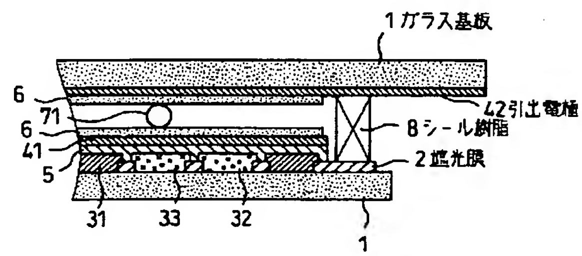
【図7】



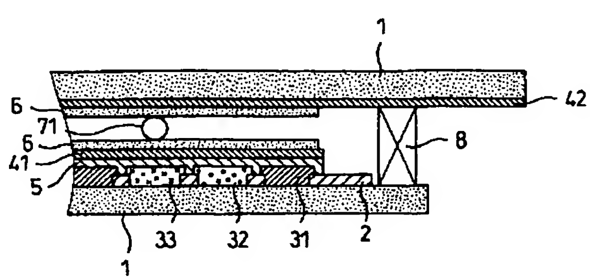
【図8】



【図9】



【図11】



【図１２】